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Amphibians and Reptiles of Luzon Island, Philippines, VI: The Herpetofauna of the Subic Bay Area

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Abstract We present detailed species accounts for 55 species of amphibians and reptiles (14 species of frogs, 24 snakes, 16 lizards, one turtle) from 24 localities in the vicinity of Subic Bay, southern Zambales Province, Luzon Island, Philippines. Although we note numerous species that are conspicuously absent in Subic Bay (and which we expect will eventually be recorded in the region), our many new records plus a summary of the available historical museum specimen data depict a diverse subset of species diversity known from the southern Zambales Mountains of southwestern Luzon. We compare our data to several other recent herpetofunal surveys from Luzon, discuss biogeographic regionalism of this complex island, and report on numerous new natural history observations for many included species. With the absence of any protected areas in the entire province, the amphibians and reptiles of Zambales should be a particularly important future conservation priority.

Keywords herpetological biodiversity, northern Philippines, Zambales Mountains

1. Introduction

Recent herpetological biodiversity survey work on the Philippine island of Luzon has revealed a rich diversity of amphibian and reptiles species (Brown, 2007; Diesmos and Brown, 2011; Diesmos *et al.,* 2002) in an island archipelago previously thought to be depauperate in herpetofaunal diversity compared to the adjacent mainland (Inger, 1954, 1966, 1999; Noble, 1931; Taylor, 1928). Additionally, high levels of localized, intra-island microendemism clearly surpass most earlier estimates (Brown *et al.,* 1996, 2000a, in review; Diesmos *et al.,* 2005; McLeod *et al.,* 2011; Siler *et al.,* 2011a), suggesting that a substantial portion of Luzon's herpetological diversity has been produced *in situ* through evolutionary processes of diversification (Brown and Diesmos, 2009).

The diversity and pockets of microendemism on Luzon can be attributed in part to its complex geological history, during which the accretion of four or five islands formed the present-day composite landmass (Hall 1996, 1998; Hashimoto, 1981). These former paleoislands correspond to four or five main montane regions of Luzon: the Zambales Mountain Range, the mountains of south central Luzon, the Cordillera Central, the Sierra Madres, and the Bicol volcanoes (Auffenberg, 1988). Each region has been demonstrated or is predicted to support high levels of herpetological endemism (Auffenberg, 1988; Brown *et al*., 1996, 2000, in review; Diesmos, 1998; Siler *et al*., 2011a). Additionally, it is clear that marked habitat heterogeneity associated with atmospheric and elevational gradients along isolated volcanic mountains provide ample opportunity for ecological processes associated with evolutionary diversification (Brown and Alcala, 1961, 1963; R. Brown *et al*., 2000a; Brown and Diesmos, 2009; Diesmos, 1998).

The Zambales Mountain Range is of particular interest when considering intra-island patterns of diversity and endemism. It constitutes the geologically distinct Zambales Ophiolite Complex (ZOC; Balete *et al*., 2009; Yumul *et al.,* 2000), which was isolated much further

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west than its present location before its accretion with Luzon's other three or four main massifs (Auffenberg, 1988; Hall, 1996, 1998; Hashimoto, 1981; Yumul *et al.,* 2003, 2009). Coupled with the ZOC's present-day isolation from the rest of Luzon by a dispersal barrier created by the Pampanga plains, the Zambales Mountain Range is geographically and ecologically isolated from the other four main mountain ranges (Brown *et al*., 1996). As a result of this isolation it is expected that patterns of endemism and levels of biodiversity of the Zambales Mountain Range may be substantial, much like other previously identified isolated biogeographic subregions of Luzon (Auffenberg, 1988; Brown *et al.,* 2000a, 2010a, in review; Siler *et al.,* 2011a; Welton *et al.,* 2010).

However, the Zambales Mountain Range and indeed much of the rest of Luzon remains insufficiently sampled for herpetofauna (Balete *et al.,* 2009; Brown *et al.,* 1996, 2000; in review; Diesmos *et al.,* 2005; Siler *et al.,* 2011a), and the current paucity of data on species diversity and distribution patterns impedes a comprehensive understanding of endemism patterns and their relation to Luzon's geological history. This fact necessitates continued and exhaustive surveys of the Zambales Mountain Range as well as other understudied montane centers of endemism within Luzon Island.

In this paper we report on the amphibians and reptiles of Subic Bay (Figure 1), southern Zambales Province. Together with Brown *et al.* (1996), this report constitutes our only knowledge of the biodiversity of amphibians and reptiles from this geologically unique and ecologically isolated faunal subregion of Luzon. Located south of the Cabangan massif (Yumul *et al.,* 2000) that forms part of the ZOC, Subic Bay Freeport Zone (SBF) was once the largest overseas American Naval Base and is now a highly commercial and industrialized center of economic growth (Bowen *et al.*, 2002). While several herpetofaunal surveys in Zambales Province and nearby Bataan Province have been conducted over the past two decades, many of which still remain unpublished, there are no summaries of herpetofauna specifically focusing on the amphibians and reptiles of Subic Bay. The only previous account of the herpetofauna of southern Zambales Mountain Range was that of Brown *et al*. (1996) who included miscellaneous Subic Bay historical museum records in a study that focused on forested areas farther north in the Zamables Mountains. Many species records reported here constitute major range extensions and important new geographical records. In this paper we summarize all previously available museum records, report on two new field surveys conducted within SBF, and provide new data on ecology and natural history of the species in this unique assemblage of amphibians and reptiles.

2. Methods

Data for this study were collected from 15–22 September

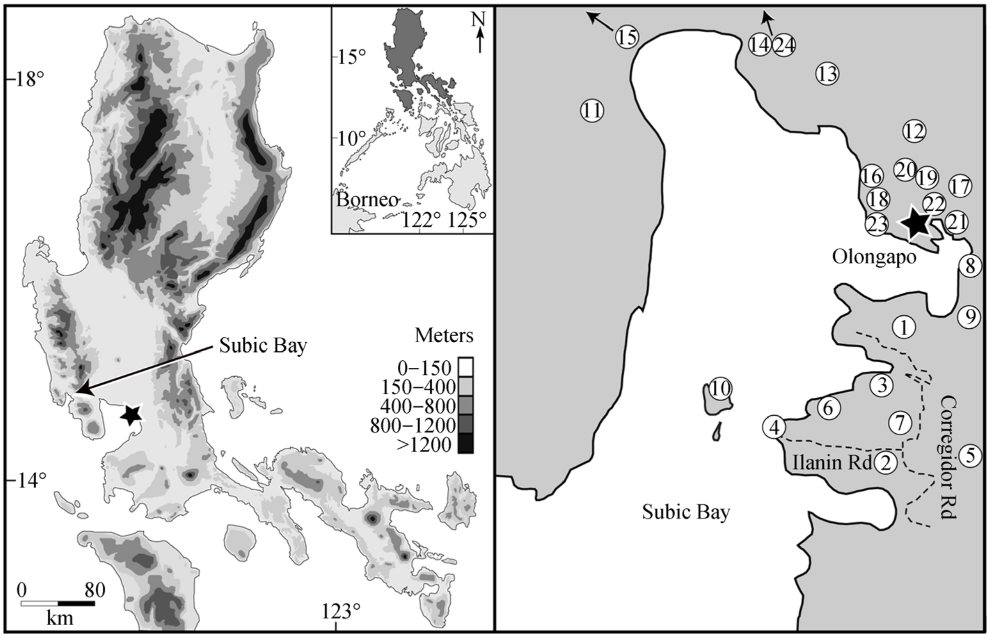

Figure 1 A Map of the northern Philippines (Left panel), indicating the position of Luzon and surrounding islands (Inset: darkly shaded) and the position of Subic Bay (Star = Manila). The right panel depicts a detailed view of the Subic Bay with numbered collection localities (Table 1), relevant roads (See text) and Olongapo City (Star) included.

2002 (field work of RMB and party), and 10 December 2010 to 3 January 2011 (field work of ADS). Both survey efforts targeted a wide variety of habitat types (Figures 2–7). RMB's surveys involved timed visual encounter surveys conducted by a party of four field workers who concentrated on Subic Bay Metropolitan Area's (SBMA) "Nav-Mag" area, the Ilanin forest, mangroves along the Triboa Bay, El Kabayo River, Boton Falls area, and the Nabasan River (Figure 1). We utilized three methods to document herpetological records and assemble a list of species presented here: night surveys of forest and roads (timed visual encounter surveys), opportunistic encounters, and road-kill encounters. Encounters with herpetofauna outside of the study sites, but still within the SBF, were also recorded. ADS's efforts involved eight transects established within Subic Bay Marine Exploratorium's (parent company of Ocean Adventure, an open water marine park) leased site, including a total of 1.4 km long stretch of stream habitat (Figure 7), 1.4 km long stretch of secondary forest habitat (Figure 6) and 8 km long stretch of paved road. In total, 24 one-hour nocturnal surveys were carried out: 8 stream surveys, 8 forest surveys and 8 road surveys. Defining 'One person hour' as the search effort by one individual per hour, these 24 hours of survey are approximated to 45 person hours. Most of this effort was focused on the 500 ha of secondary forest in SBF encompassed by Subic Bay Marine Exploratorium's leased site (Figure 1) as well as a high traffic density paved road, bordered on each side with secondary and scrub forests, leading from Ocean Adventure on Ilanin Road to Building 8494 on Corregidor Road (Figure 2).

Voucher specimens were collected and preserved according to standardized methods (Simmons, 2002; ASIH, 2004; Reynolds *et al.*, 1994) by RMB during the 2002 surveys; all specimens were deposited in accredited natural history collections at the National Museum of the Philippines (PNM) and the University of Texas Natural History Collections at the Texas Natural Science Center (TNHC). Specimens were identified using the taxonomy of Taylor (1920a, b, 1922a, b), Alcala (1986), Alcala and Brown (1998), Inger (1954), Brown (2007), Brown and Alcala (1978, 1980, 1994), Leviton (1961, 1962, 1963a, b, 1964a–c, 1965a, b, 1968a, b, 1970, 1979), and Linkem *et al.* (2010a); specimens were photographed in life whenever possible. Subsequent work by ADS did not involve specimen collection due to permit restrictions but all specimens were extensively photographed to allow for

Table 1 Survey and collection localities in and around the vicinity of Subic Bay

Site No.	General locality	Specific locality
1	Subic Bay Metropolitan Area (SBMA) Naval Base Nav-Mag area	Nav-Mag area, Nabasan River
2	SBMA Naval Base Nav-Mag area	Ilanin River
3	SBMA Naval Base Nav-Mag area	Ilanin Forest and Triboa Bay
4	SBMA Naval Base Nav-Mag area	Ocean Adventure/Camayan Beach Resort, Ilanin Road
5	SBMA Naval Base Nav-Mag area	Hill 394
6	SBMA Naval Base Nav-Mag area	Building Area; Navy Yard, U. S. Naval Reservation
7	SBMA Naval Base Nav-Mag area	Munitions bunkers
8	SBMA Naval Base Nav-Mag area	El Kabayo River
9	SBMA Naval Base Nav-Mag area	Boton Falls
10	Subic Bay	Grande Island
11	Subic Bay	Mt. Calaclan and Calaclan River
12	Subic Bay	Santa Rita Valley
13	Subic Bay	Maquinaya Valley
14	Subic Bay	Castillejos
15	Subic Bay	Barangay San Felipe
16	Municipality of Olongapo City	10–18 km E of Olongapo
17	Municipality of Olongapo City	6 km NW of Olongapo
18	Municipality of Olongapo City	Ylinquin River Valley
19	Municipality of Olongapo City	Barangay Parola
20	Municipality of Olongapo City	Barangay Cablan
21	Municipality of Olongapo City	East Olongapo City
22	Municipality of Olongapo City	Olongapo City proper
23	Municipality of Olongapo City	Telegraph trail
24	Municipality of San Marclino	Barangay Aglao, Aglao River

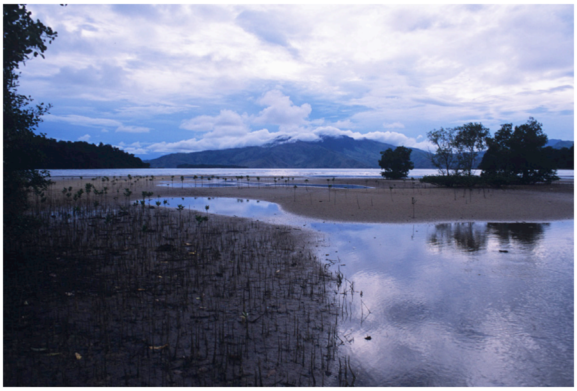

Figure 2 View from the Triboa Bay. Photograph by RMB.

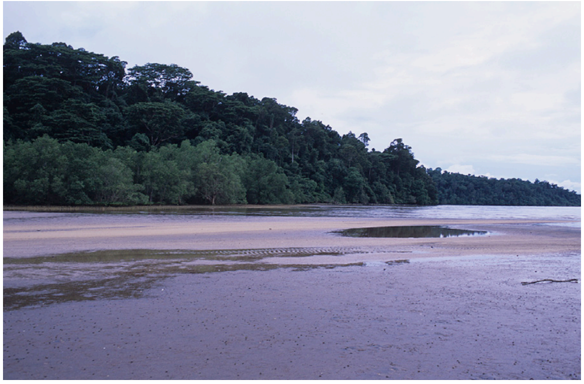

Figure 3 Coastal Forest along the Triboa Bay, Subic Bay Nav-Mag Area. Photograph by RMB.

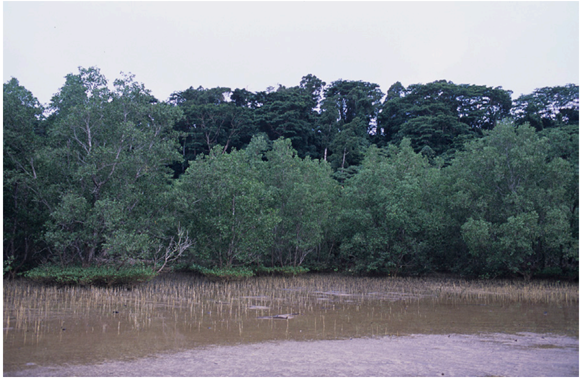

Figure 4 Characteristic appearance of exterior mangroves of mangroves of the Triboa Bay. Photograph by RMB.

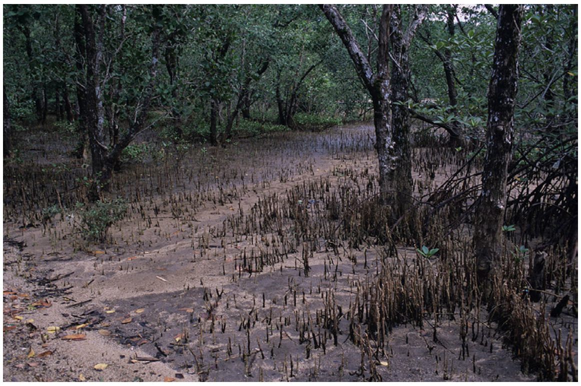

Figure 5 Characteristic appearance of interior mangroves of mangroves of the Triboa Bay, Subic Bay Nav-Mag Area. Photograph by RMB.

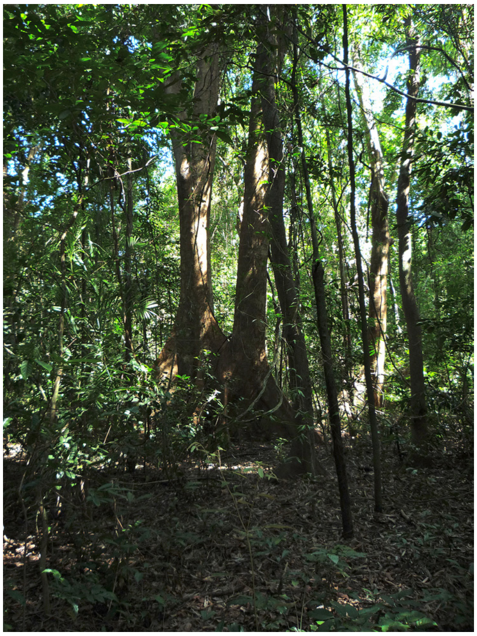

Figure 6 Characteristic appearance of understory vegetation of the Nabasan Forest. Photograph by ADS.

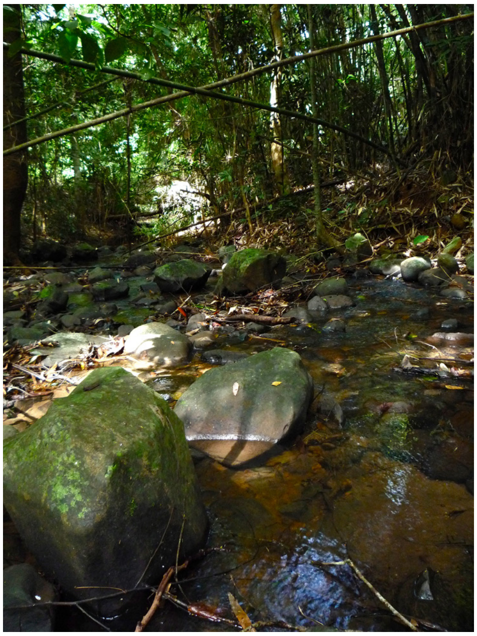

Figure 7 Typical appearance of stream habitats in the Ilanin River drainage. Photograph by ADS.

confident identification. In this report we also incorporate older collections by U. S. servicemen, deposited at the Smithsonian Institution (USNM), the California Academy of Sciences (CAS), the Field Museum of Natural History (FMNH), and the University of Kansas Biodiversity Institute (KU). Several records of amphibians and reptiles recorded by staff of Ocean Adventure are included in this report when confirmed with photographs of sufficient quality to ensure proper identification. Our synthesis of all records results in a total of 24 sites (Table 1) where herpetological specimens have been confirmed with specimens and/or with high quality photographs.

3. Results

Species accounts: We present species accounts for a total of 55 species of amphibians and reptiles: 14 species of frogs, 24 snakes, 16 lizards and one turtle (Table 2). The species encountered during ADS's surveys includes seven species of frogs, four snakes, three lizards, and one turtle. Sixteen remaining species were found opportunistically or discovered as road-kill; additional historical records from museum collections are summarized below.

Amphibia

Order: Anura (Frogs and toads)

Table 2 Amphibians (anurans) and reptiles (lizards and snakes) from the vicinity of Subic Bay, Zambales Province, Luzon Island. N: Major new species distribution record, first recorded during this study; BA80: First reported from Subic Bay by Brown and Alcala (1980); B96: Previously reported from Subic Bay (Brown *et al*., 1996); L61: Leviton (1961); L64a: Leviton (1964a); L65a: Leviton (1965a); L68: Leviton (1968).

Taxon	Record
AMPHIBIA	
Bufonidae	
Rhinella marina (Linnaeus 1758)	B96
Ceratobatrachidae	
Platymantis corrugatus (Duméril 1853)	N
Platymantis mimulus Brown, Alcala, and Diesmos 1997	N
Dicroglossidae	
Fejervarya vittigera (Wiegmann 1834)	B96
Fejervarya cancrivora (Gravenhorst 1829)	B96
Limnonectes macrocephalus (Inger 1954)	B96
Limnonectes woodworthi (Taylor 1923)	N
Occidozyga laevis (Günther 1859)	B96
Microhylidae	
Kaloula picta (Duméril and Bibron 1841)	B96
Ranidae	
Hylarana erythraea (Schlegel 1837)	N
Sanguirana luzonensis (Boulenger 1896)	B96
Hylarana similis (Günther 1873)	B96
Rhacophoridae	
Philautus surdus (Peters 1863):	
Polypedates leucomystax Gravenhorst 1829	B96
REPTILIA (Lizards)	
Agamidae	
Bronchocela marmorata Gray 1845	B96
Draco spilopterus (Wiegmann 1834)	B96
Gekkonidae	
Cyrtodactylus philippinicus (Steindacher 1867)	N
Gehyra mutilata (Wiegmann 1834)	B96
Gekko gecko (Linnaeus 1758)	B96
Hemidactylus frenatus Duméril and Bibron 1836	B96
Hemidactylus platyurus (Schneider 1792)	B96
Lepidodactylus cf *planicaudus* Stejneger 1905	N
Scincidae	
Emoia atrocostata (Lesson 1830)	N
Eutropis cumingi (Brown and Alcala 1980)	BA80
Eutropis multicarinata borealis (Brown and Alcala 1980)	BA80
Eutropis multifasciata (Kuhl 1820)	B96
Lamprolepis smaragdina philippinica (Mertens 1829)	B96
Pinoyscincus abdictus aquilonius (Brown and Alcala 1980)	BA80
Otosaurus cumingi (Gray 1845)	BA80
Varanidae	
Varanus marmoratus (Wiegmann 1834)	B96
REPTILIA (Snakes)	
Boidae	
Broghammerus reticulatus (Schneider 1801)	B96
Colubridae	
Ahaetulla prasina preocularis (Taylor 1922)	L68
Boiga angulata (Peters 1861)	N
Boiga philippina (Peters 1867)	N
Cerberus rynchops (Schneider, 1799)	B96
Chrysopelea paradisi (Boie 1827)	B96
Coelognathus erythrura manillensis Jan 1863	B96
Cyclocorus lineatus lineatus (Reinhardt 1843)	B96
Dendrelaphis caudolineatus luzonensis Leviton 1961	L61
Dendrelaphis marenae Vogel and Rooijen 2008	B96
Dryophiops philippina (Boulenger 1896)	L64a
Gonyosoma oxycephalum (Boie 1827)	N
Lycodon capucinus (Boie 1827)	L65a
Oligodon ancorus (Girad 1858)	N
Ptyas luzonensis (Günther 1873)	N
Rhabdophis spilogaster (Boie 1827)	B96
Elapidae	
Hemibungarus calligaster (Wiegmann 1835)	B96
Lapemis hardwickii Gray 1834	B96
Laticauda colubrina (Schneider 1799)	B96
Naja philippinensis Taylor 1922	B96
Ophiophagus hannah (Cantor 1836).	N
Viperidae	
Trimeresurus flavomaculatus (Gray 1842)	N
Typhlopidae	
Ramphotyphlops braminus (Daudin 1803)	B96
Typhlops ruficaudus (Gray 1845)	B96
REPTILIA (Turtles)	
Bataguridae	
Cuora amboinensis (Daudin 1802)	B96

Family: Bufonidae (Toads)

***Rhinella marina* (Linnaeus 1758):** This introduced species (Alcala and Brown, 1998; Diesmos *et al.*, 2006) was found at the Subic Bay Boardwalk (near Site 3). No individuals were encountered in the Ilanin Forest. USNM specimens were collected under trash in a residential area in Barangay Parola. Site 3: No specimens; Site 19: USNM 344832–33.

Family: Ceratobatrachidae (Litter frogs)

***Platymantis corrugatus* (Duméril 1853):** *Platymantis corrugatus* (Figure 8) was encountered in a variety of habitats during both stream surveys and forest surveys not near any body of freshwater. In stream transects, this species was found on, and underneath leaf litter or on rocks. In forest transects, it was found on rotting logs and on or under leaf litter. Two specimens were collected by triangulating on calls in a bamboo thicket behind mangroves bordering Triboa Bay. Site 3: TNHC 61988, one uncatalogued specimen deposited in PNM.

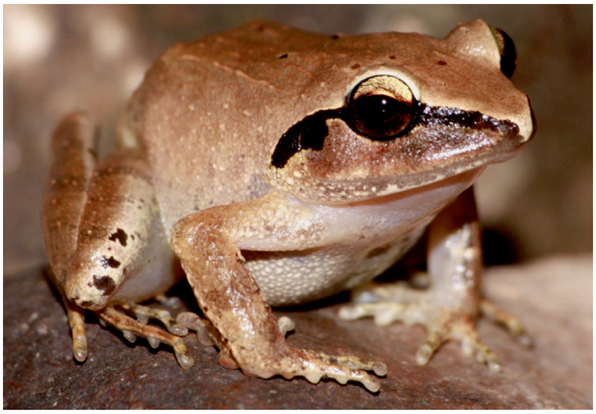

Figure 8 *Platymantis corrugatus* from Site 3 (Specimen not collected). Photograph by ADS.

***Platymantis mimulus* Brown, Alcala, and Diesmos 1997:** Like *P. corrugatus*, this species (Figures 9, 10) was found both during stream and forest surveys. Several individuals were found in a forest edge, approximately 5 m from a sandy shore coastline. Identified by its distinctive advertisement call (Brown *et al.,* 1997), five distinct color morphs were found, with variation in dorsal patterns and overall coloration. Multiple specimens were collected by triangulating on calls in a bamboo thicket behind mangroves bordering Triboa Bay. One specimen was collected along the muddy road leading to Hill 394. Site 1: Two uncatalogued specimens in PNM; Site 3: Two uncatalogued specimens in PNM; Site 5: TNHC 62047; Site 9: TNHC 62046; Site 16: CAS 15588, 15591–93; Site 21: CAS 15587.

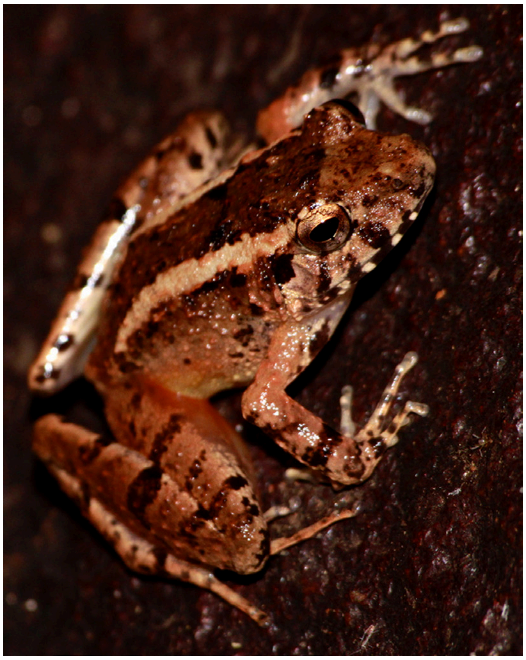

Figure 9 One color morph (Dorsolateral stripes) of *Platymantis mimulus* from Site 3 (Specimen not collected). Photograph by ADS.

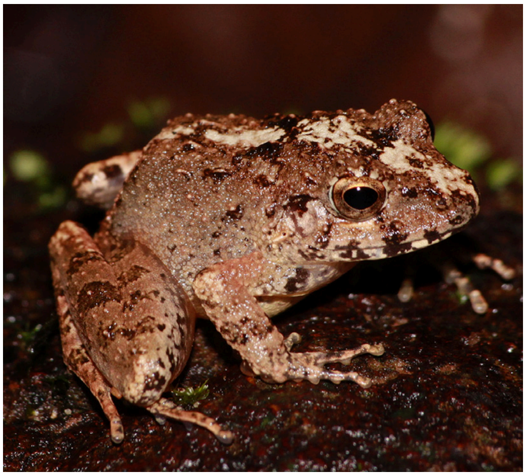

Figure 10 Another color morph (Vertebral stripe) of *Platymantis mimulus* from Site 3 (Specimen not collected). Photograph by ADS.

Family: Dicroglossidae (Fanged frogs, paddy frogs, and puddle frogs)

***Fejervarya cancrivora* (Gravenhorst 1829):** Specimens of this widespread brackish water frog were collected along the muddy banks of mangrove second growth forest along Triboa Bay. We observed this species feeding on small crabs in tidal flats in the bay. Site 3: Three uncatalogued specimens in PNM; Site 16: CAS 15607–15; Site 21: CAS 15616–24.

***Fejervarya vittigera* (Wiegmann 1834):** Several specimens were collected in puddles along the muddy road leading to Hill 394. Several specimens were observed in water-filled road-side ditches near the edge of the Ilanin Forest. Site 5: TNHC 62464, one uncatalogued specimen in PNM; Site 16: KU 94409; Site 21: CAS 15625, 15632.

***Limnonectes macrocephalus* (Inger 1954):** A single specimen of *L. macrocephalus* has been recorded "in the vicinity of Subic Bay." Given the absence of this species in all of our surveys and the ubiquitous presence of *L. woodworthi* the SBMA campus and SBF, we consider this record somewhat suspect. Future surveys in a variety of habitats surrounding the Subic Bay area will be necessary to confirm its anticipated presence. Site 21: CAS 15626.

***Limnonectes woodworthi* (Taylor 1923):** This species (Figure 11) was found in or within the vicinity of flowing streams, in high densities. Numerous specimens were observed on rocks on the banks of the Ilanin River, bordering Triboa Bay and several specimens were found in small tributary streams running into this river from the Ilanin Forest. Two specimens were taken from under logs rotting in sandy soils of bamboo stands on the edge of the Ilanin Forest. Site 1: Three uncatalogued specimens in PNM; Site 2: Three uncatalogued specimens in PNM Site 3: TNHC 62946–52; Site 8: TNHC 62953; Site 9: TNHC 62954–55.

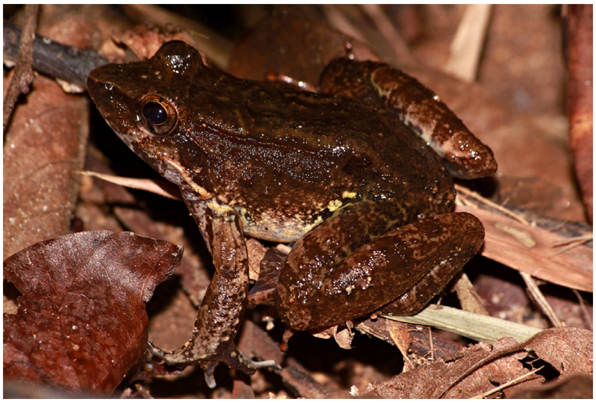

Figure 11 *Limnonectes woodworthi* from Site 1 (Specimen not collected). Photograph by ADS.

***Occidozyga laevis* (Günther 1859):** We found this species (Figure 12) buried under leaves in muddy pools where water flow was near stagnant. Additional specimens were collected from puddles on the edge of mangroves in Triboa Bay and from puddles along the muddy road to Hill 394. Two distinct color morphs were observed in this species, one with a light mid-dorsal stripe and another with a bright orange collar and no mid-dorsal stripe. Site 3: TNHC 63048; Site 5: 63048–51; Site 12: CAS 15577–80; Site 16: CAS 15594–606; Site 21: CAS 15581–86, 15626–29, 15633–37.

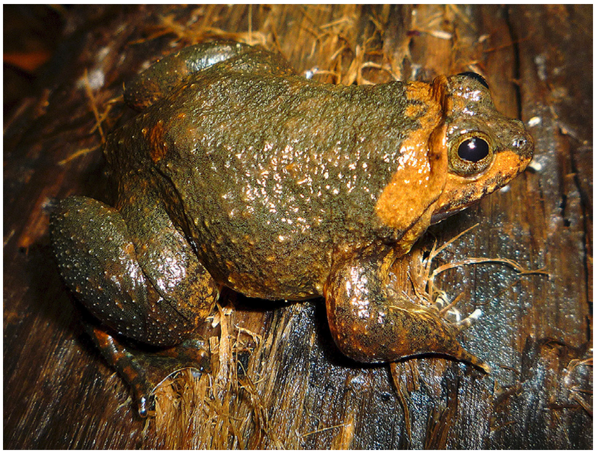

Figure 12 *Occidozyga laevis* from Site 3 (Specimen not collected). Photograph by ADS.

Family: Microhylidae (Narrow mouth frogs)

***Kaloula picta* (Duméril and Bibron 1841):** One specimen was found under woody debris on the bank of the Ilanin River and one specimen was taken within the Nabasan River drainage. Other specimens have been collected under trash piles within the Olongapo City limits. Site 1: KU 62471; Site 10: 15707–10; Site 13: CAS 15574; Site 21: CAS, 15630–31.

Family: Ranidae (True frogs)

***Hylarana erythraea* (Schlegel 1837):** An introduced species (Diesmos *et al*., 2006), *H. erythraea* (Figure 13) was found in open, grassy disturbed areas associated with water. It was found in high densities in or near ephemeral ponds adjacent to the Ilanin Road. Several specimens were collected along the banks of the Ilanin River and

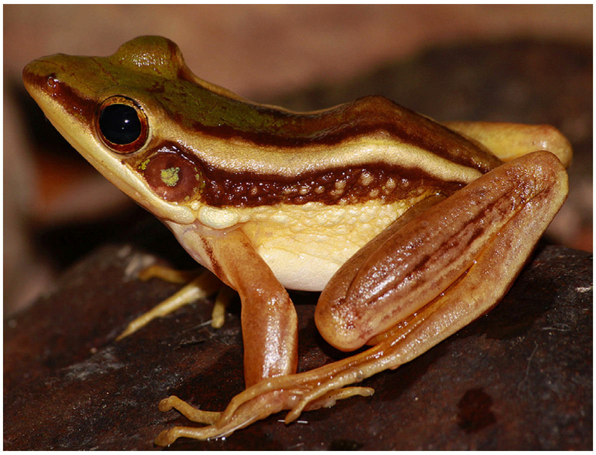

Figure 13 *Hylarana erythraea* from Site 3 (Specimen not collected). Photograph by ADS.

one specimen was collected along the edge of mangroves in Triboa Bay. Site 1: Four uncatalogued specimens in PNM; Site 3: TNHC 62807–08.

***Hylarana similis* (Günther 1872):** This species (Figure 14) was encountered in high densities near flowing water on rocks and sandy banks of the Ilanin River and tributary streams. Two distinct color patterns were observed (Brown and Guttman, 2002); one with a uniformly brown dorsum and another with highly mottled yellow-gold patterns against a brown dorsum. Site 1: TNHC 63021; Site 3: TNHC 63017–20; Site 16: CAS 15612.

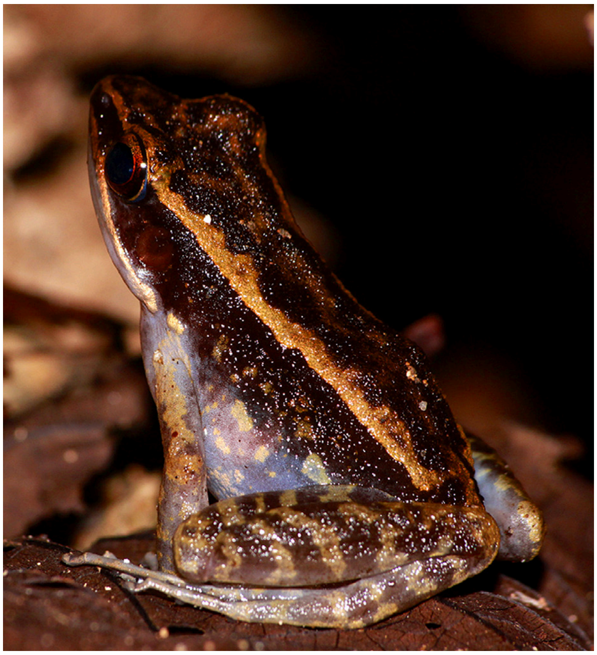

Figure 14 *Hylarana similis* from Site 3 (Specimen not collected). Photograph by ADS.

***Sanguirana luzonensis* (Boulenger 1896):** This common and widespread Luzon faunal region endemic (Brown *et al*., 2000a, 2000b; Fuiten *et al*., 2011) has only been recorded once, east of Olongapo. We suspect it was more widespread in the Subic Bay area but to date, only the single collection has been recorded. Site 16: CAS 15589–90.

Family: Rhacophoridae (Asian treefrogs)

***Philautus surdus* (Peters 1863):** Only a single specimen of this widespread Philippine endemic (Brown and Alcala, 1994) species has been collected in the Subic Bay area (Barangay Angela). Additional survey work in the rainy season will be necessary to confirm its presence within SBMA. Site 24: CAS 15710.

***Polypedates leucomystax* (Gravenhorst 1829):** *Polypedates leucomystax* (Figure 15) was found both in forests and near streams (usually on branches along the sides of streams) and along the Ilanin Road near ephemeral bodies of water. Several specimens were found in a grassy field, along the edge of a puddle on the shore of Triboa Bay. This species preferred microhabitat (low elevation standing water) combined with its genetic uniformity throughout the Philippines led Brown *et al*. (2010b) to suggest that *P. leucomystax* may have been transported by humans throughout the archipelago via trade of agricultural and forest products. Site 2: TNHC 62859; Site 3: One uncatalogued specimen in PNM; Site 11: CAS 15575; Site 12: CAS 15576; Site 19: FMNH 202702.

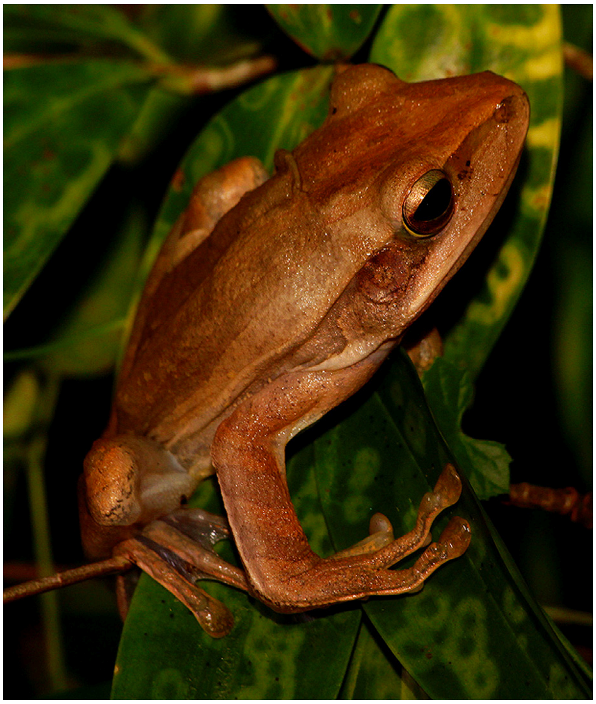

Figure 15 *Polypedates leucomystax* from Site 3 (Specimen not collected). Photograph by ADS.

Reptilia

Order: Squamata (Lizards)

Family: Agamidae (Angle head lizards)

***Bronchocela marmorata* Gray 1845:** A juvenile (Figure 16) was observed by ADS on a branch along the Corregidor Road about 10 m away from Building 8494. A specimen was collected by J. C. Thompson in 1907 in the Maquinaya Valley. Site 6: No specimens; Site 13: CAS 15457

***Draco spilopterus* (Wiegmann 1834):** In the Ilanin Forest, we captured one specimen from 2 m above the

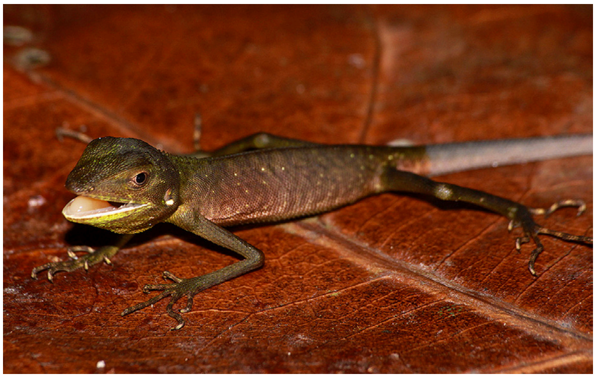

Figure 16 *Bronchocela marmorata* from Site 3 (Specimen not collected). Photograph by ADS.

ground on the trunk of a 0.5 m circumference tree in the late morning and another sleeping in a thin branch of a sapling on the bank of a small stream. Site 3: TNHC 62793, one uncatalogued specimen in PNM; Site 11: CAS 15461, 15469, 15471; Site 18: CAS 15464–67, 15470; Site 21: CAS 15468.

Family: Gekkonidae (Geckos)

***Cyrtodactylus philippinicus* (Steindachner 1867):** Two individuals of this widespread Philippine species (Figure 17; Siler *et al.,* 2010) were found on vegetation near the Ilanin River. One individual was spotted on a branch about 5 m above the stream. Site 1: TNHC 62843; Site 3: TNHC 62842, one uncatalogued specimen in PNM; Site 19: USNM 345004–09.

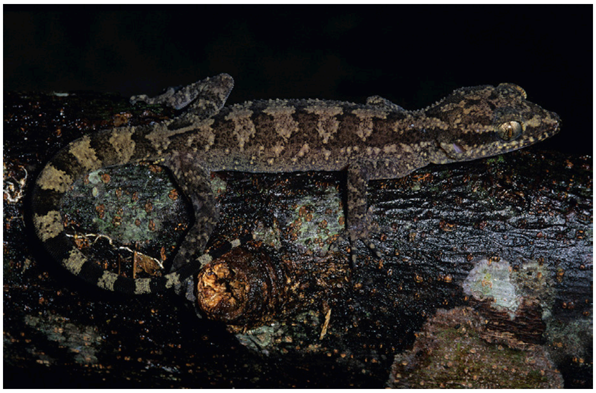

Figure 17 *Cyrtodactylus philippinicus* from Site 1 (TNHC 62842). Photograph by RMB.

***Gehyra mutilata* (Wiegmann 1834):** This species was frequently encountered on walls inside and outside buildings away from exterior lights. One specimen was collected from the trunk of a large tree that had fallen and was suspended over a tributary stream of the Ilanin River. Several additional specimens were collected in woody debris piles along the walls of abandoned munitions bunkers surrounded by forest. Site 1: TNHC 62878, one uncatalogued specimen in PNM; Site 7: three uncatalogued specimens in PNM; Site 10: CAS 15424.

***Gekko gecko* (Linnaeus 1758):** By far the most conspicuous reptile in close proximity to humans, *G. gecko* was found frequently, in the forest, along roads, in and around buildings throughout the SBF and the larger SBMA. *Gekko gecko*'s distinctive vocalizations can be heard calling throughout the day and night year round. One specimen was found on the trunk of a small mangrove tree in Triboa Bay. Site 3: TNHC 62904; Site 11: CAS 15385; Site 21: CAS 15383–84, 15388, 15390–95.

***Hemidactylus frenatus* (Duméril and Bibron 1836):** Frequently sighted on walls within buildings and under exterior lights, this species (Figure 18) was also collected on the trunk of a small mangrove tree in Triboa Bay, in trash piles near munitions bunkers, on the wall of a small concrete shed near El Kabayo River. Site 3: TNHC 62817–18; Site 6: USNM 344836–38; Site 10: CAS 15419–23; Site 15: CAS 15474; Site 16: KU 94447–48; Site 21: CAS 15386–87, 15389, 15396–15418, 15425.

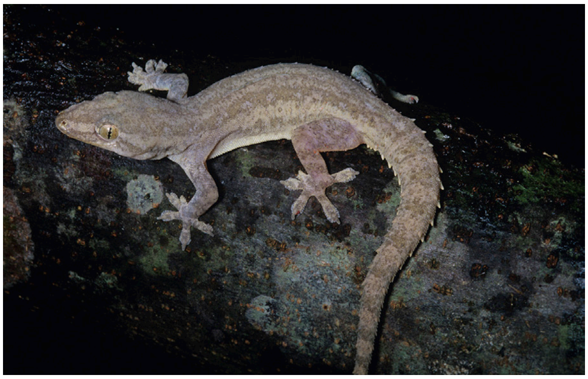

Figure 18 *Hemidactylus frenatus* at Site 6 (TNHC 62818). Photograph by RMB.

***Hemidactylus platyurus* (Schneider 1792):** Often sighted on walls both inside and outside buildings under exterior lights, this species has been collected with *H. frenatus* in a variety of habitats. Site 16: KU 94487; Site 21: CAS 15426–27.

***Lepidodactylus* cf *planicaudus* Stejneger 1905:** A single *Lepidodactylus* specimen of uncertain taxonomic status was collected from under bark on a large (3 m circumference) tree in the Ilanin Forest. Known from the Visayan Islands in the central Philippines, *L. planicaudus* has not been recorded from Luzon. We suspect this specimen may represent an undescribed species. Site 5:

KU 327768.

Family: Scinidae (Skinks)

***Emoia atrocostata* (Lesson 1830):** A single specimen of this coastal habitat species (Brown and Alcala, 1980) was collected in the vicinity of Subic Bay. We suspect that *E. atrocostata* will be documented as a common coastal inhabitant (Mangroves, palm plantations) with future studies in the vicinity of Subic Bay. Site 21: CAS 15432.

***Eutropis cumingi* (Brown and Alcala 1980):** One individual was found at the edge of a forest trail within the Ilanin Forest. Three others were captured beneath rotting logs, away from the forest edge, in the Ilanin Forest. Subic Bay is the type locality for this species (Brown and Alcala, 1980). Site 3: Four uncatalogued specimens, deposited in PNM; Site 11: CAS 15455; Site 15: CAS 15473; Site 18: CAS 15452; Site 21: CAS 15450–51, 15456; Site 24: CAS 15472

***Eutropis multicarinata borealis* (Brown and Alcala 1980):** We observed several specimens on the bank of the Nabasan River in mixed primary and second growth forest. This species is invariably associated with rotting logs on the forest floor. One specimen was sighted as it ran along a large downed log and others were captured beneath rotting logs. Brown and Alcala's (1980) type series for this subspecies was collected by T. C. Thompson in the Santa Rita Valley (Site 12). Site 3: One uncatalogued specimen in PNM; Site 12: CAS 15447–49; Site 18: CAS 15453.

***Eutropis multifasciata* (Kuhl 1820):** Individuals of this species (Figures 19, 20) were frequently encountered in a variety of habitats, including the edges of forest trails, gardens, buildings and the edge of beaches. We collected a large series of this species within abandoned munitions bunkers and among piles of corrugated tin and trash surrounding the bunkers. Site 1: TNHC 62999, six uncatalogued specimens in PNM; Site 3: TNHC 62997–98, 62909; Site 7: TNHC 62910–15; Site 20: USNM 344967.

***Lamprolepis smaragdina philippinica* (Mertens 1928):** Individuals of this species frequently can be observed on large trees of the SBF campus and former naval reservation. Two specimens were collected from the trunk of a large tree on Hill 394. A forthcoming phylogenetic analysis of *L. smaragdina* (Linkem *et al.,* in press) has demonstrated that Philippine populations of this species segregate into two separate clades, one of which is most closely related to Indonesian, Palauan, and Papuan lineages, suggesting that two or more distinct species may occur in the country. Site 5: Two uncatalogued specimen in PNM.

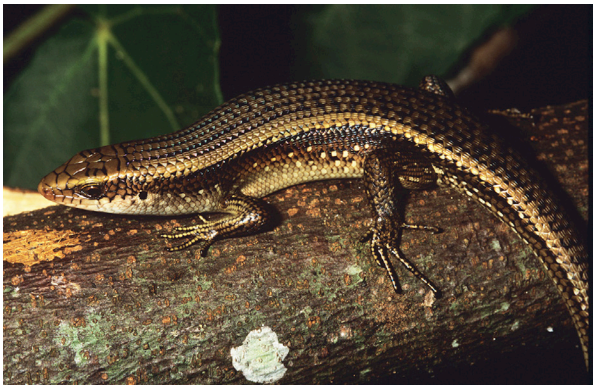

Figure 19 *Eutropis multifasciata*, an example of a colorless morph (Uncatalogued specimen, deposited in PNM) from Site 7. Photograph by RMB.

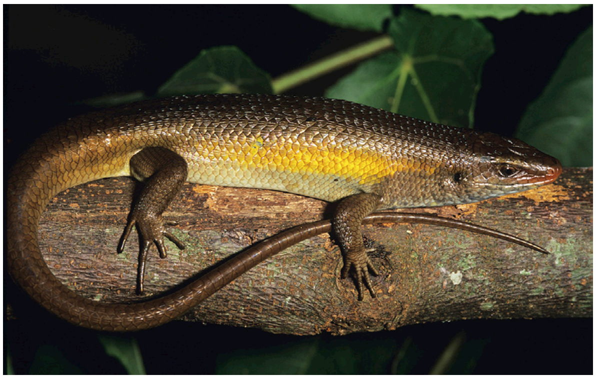

Figure 20 *Eutropis multifasciata*, an example of the yellow morph (TNHC 62911) from Site 7. Photograph by RMB.

***Otosaurus cumingi* (Gray 1845):** This species can be observed in patches of sun in forested areas where it actively forages during the day. One specimen was collected on the ground among rocks and another was collected on the buttress of a large tree in the Ilanin Forest. The genus *Otosaurus* was recently resurrected from the synonymy of *Sphenomorphus* by Linkem *et al.* (2011). Site 1: One uncatalogued specimen in PNM; Site 3: TNHC 62749; Site 5: One uncatalogued specimen in PNM; Site 11: CAS 15438

***Pinoyscincus abdictus aquilonius* (Brown and Alcala 1980):** Many specimens of this common taxon have been collected from a variety of habitats in the vicinity of Subic Bay. We frequently encountered this species in sunspots and along forest edges bordering the Ilanin Forest, on the banks of the El Kabayo and Nabasan rivers. Specimens were active in the morning and were collected around tree buttresses, stream bank rocks, and leaf litter in forest. The genus *Pinoyscincus* was recently described by Linkem *et al.* (2011) to accommodate the large-bodied species of the *S. jagori, S. abdictus,* and *S. coxi* Complex (Linkem *et al.* 2010a). Our Site 3 specimens were included in a recent phylogenetic study based on DNA sequence data and were determined to be members of Clade 8 (Linkem *et al.* 2010a). Despite the presence of several suspected undescribed species in this complex (Linkem *et al.,* 2010a), we assume that the species reported here is true *Pinoyscincus abdictus aquilonius* because the holotype (CAS 15444) for this subspecies was collected in Subic Bay. However, the frequent occurrence of more than one sympatric species per locality in this group (Linkem *et al*. 2010a) suggests at least the possibility that additional, as of yet unsampled, lineages may coexist in the area. Site 1: Two uncatalogued specimens at PNM; Site 3: TNHC 63108–17, seven uncatalogued specimens at PNM; Site 5: KU 327670; Site 11: CAS 15439, 15441–42, 15445; Site 12: CAS 15437; Site 16: CAS 15440; Site 18: CAS 15443–44

Family: Varanidae (Monitor lizards)

***Varanus marmoratus* (Wiegmann 1834):** A foraging juvenile was found in the garden outside Building 8494. Two additional specimens were collected in snare traps set in mangroves bordering Triboa Bay (Figure 21). Site 1: TNHC 63000; Site 3: One uncatalogued specimen at PNM; Site 11; CAS 15430; Site 21: CAS 15428–29, 15431.

Order: Squamata (Snakes)

Family: Pythonidae (Pythons)

***Broghammerus reticulatus* (Schneider 1801):** A subadult roadkill was found on the Ilanin Road. An additional small specimen (Figure 22) was found inside the dry rotting loam of a rotting tree stump (4 m circumference) in the Ilanan Forest. The staff of Ocean Adventure routinely capture and relocate pythons in the immediate vicinity of the facility, and several reports have involved particularly large specimens (⩾ 3 m; ADS, personal communication). Site 3: One uncatalogued specimen deposited in PNM; Site 10: CAS 15186–88; Site 12: CAS 15184–85.

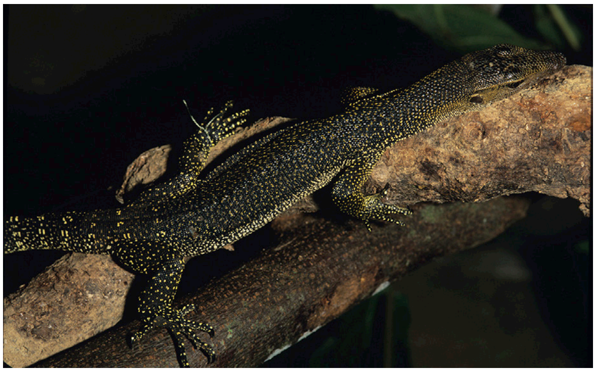

Figure 21 *Varanus marmoratus* (TNHC 63000) from Site 3. Photograph by RMB.

Family: Colubridae (Common, non-venomous snakes)

***Ahaetulla prasina preocularis* (Taylor 1922):** Both juveniles and adults are frequently found along the edges of roads, forest trails, edges, and gaps, and are often encountered on branches above streams (Leviton, 1968a; Brown *et al.,* 2000a; Siler *et al.,* 2011a). This species (Figures 23) was also commonly found dead on roads. Two specimens were collected from branches of mangroves along Triboa Bay and a third specimen

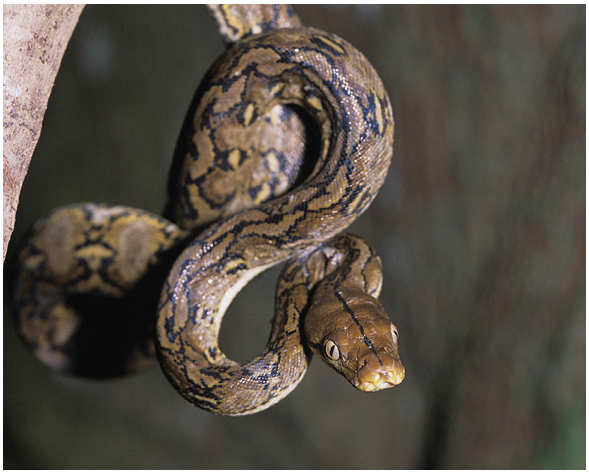

Figure 22 *Broghammerus reticulatus* (Uncatalogued specimen, deposited in PNM) from Site 3. Photograph by RMB.

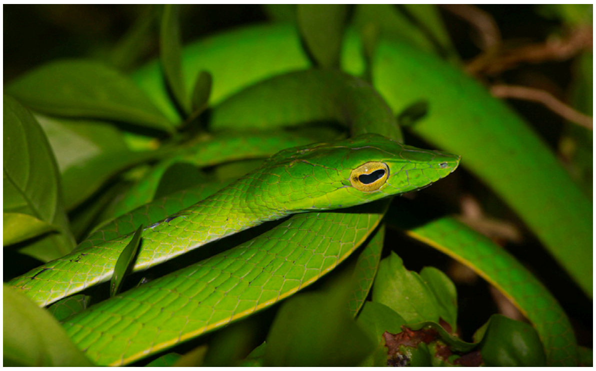

Figure 23 *Ahaetulla prasina* preocularis, green morph, photographed at Site 3 (Specimen not collected). Photograph by ADS.

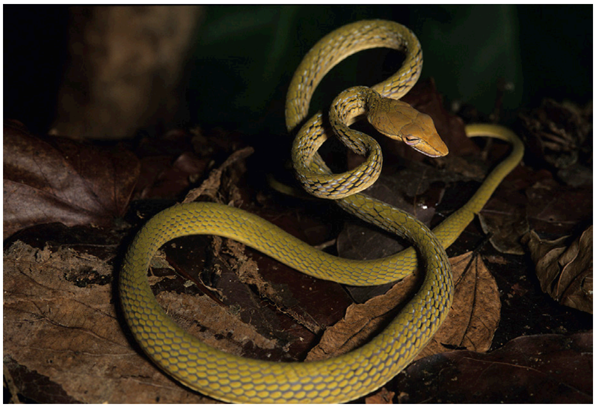

Figure 24 *Ahaetulla prasina* preocularis, yellow morph, from Site 3 (TNHC 62721). Photograph by RMB.

was collected as it slept two meters from the group in the branches of a sapling along the El Kabayo River. Site 1: TNHC 62722; Site 3: TNHC 62721; Site 8: One uncatalogued specimen at PNM; Site 11: CAS 15322; Site 16: KU 94547

***Boiga angulata* (Peters 1861):** A live specimen (Figure 25) was captured, photographed, and released by Ocean Adventure staff members in 2010. Site 3: No specimens (Photo voucher by L. J. A. Suarez).

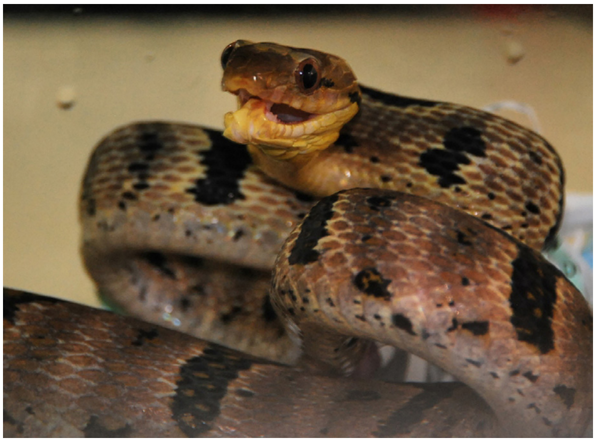

Figure 25 *Boiga angulata* from Site 4 (Specimen not collected). Photograph by L. J. A. Suarez.

***Boiga philippina* (Peters 1867):** One live adult (Figure 26) was caught, photographed, and released near Camayan Beach Resort (Ilanin Road), and another juvenile road-kill was found on the Corregidor Road very near Building 8494. This species is otherwise only known from northeast Luzon and the Babuyan Island Group (Leviton, 1970; Oliveros *et al.,* 2011). Site 3: No specimens (Photo voucher by L. J. A. Suarez).

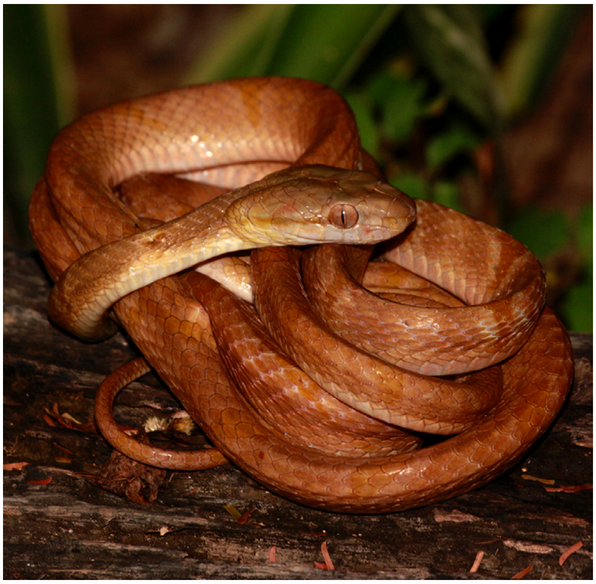

Figure 26 *Boiga philippina* from Site 3 (Specimen not collected). Photograph by ADS.

***Cerberus rynchops* (Schneider 1799):** A live adult specimen was found on Camayan Beach (but not collected); two specimens were collected in the Ilanin River where they were actively foraging in rapidly flowing river water between 2100–2200 hours. This species is found throughout the Philippines (Gyi, 1970). Site 2: Two uncatalogued specimens, deposited at PNM; Site 11: CAS 15303; Site 22: CAS 15302–03

***Chrysopelea paradisi* (Boie 1827):** One large adult was found in the garden outside Building 8494 and another (Figure 27) was captured, photographed, and released near Camayan Beach Resort (Ilanin Road). Site 3: No specimens (Photo voucher by L.J.A. Suarez); Site 6: No specimens.

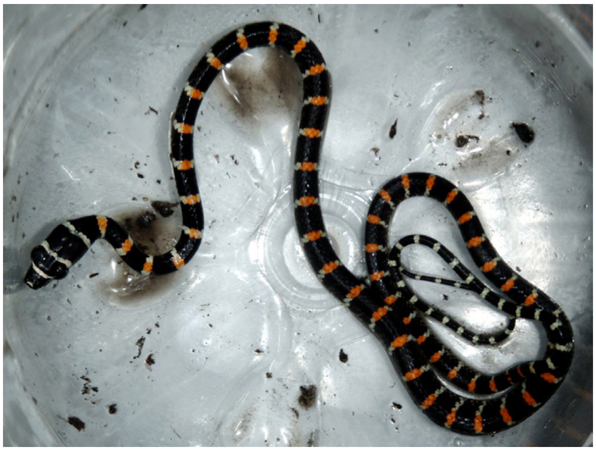

Figure 27 Juvenile *Chrysopelea paradisi* from Site 4 (Specimen not collected). Photograph by L. J. A. Suarez.

***Coelognathus erythrura manillensis* (Jan 1863):** This somewhat common Luzon subspecies (Leviton, 1979) has only been recorded once in Subic Bay, at Barangay Cablan. Site 20: USNM 344839

Cyclocorus lineatus lineatus **(Reinhardt 1843):** Several specimens of this common Luzon faunal region snake (Figure 28; Leviton, 1965b) were collected under rocks in the Nabasan River. One individual was found under leaf litter about 10 m away from a stream. Site 1: TNHC 62743; Site 3: One uncatalogued specimen at PNM; Site 11: CAS 15240–41.

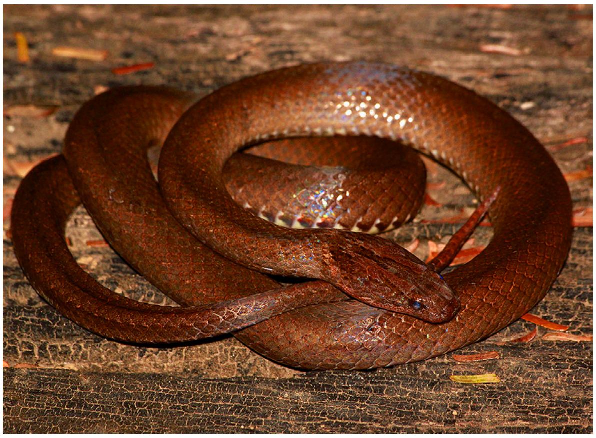

Figure 28 *Cyclocorus lineatus* lineatus from Site 3 (Specimen not collected). Photograph by ADS.

Dendrelaphis caudolineatus luzonensis **(Leviton 1961):** A total of four dead *D. c. luzonensis* were found along the Ilanin Road from November 10 to January 11 (Figure 29). The Luzon population is morphologically distinct (Leviton, 1961) and probably warrants recognition as a full species. Site 6: CAS 15272; Site 10: CAS 15274–75; Site 13, CAS 15273; Site 22: CAS 15271–75.

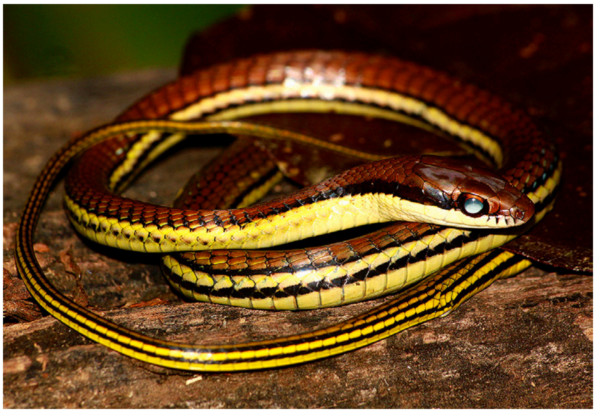

Figure 29 *Dendrelaphis caudolineatus luzonensis* from Site 3 (Specimen not collected). Photograph by ADS.

Dendrelaphis marenae **Vogel and Van Rooijen 2008:** Known only from Olongapo City area, this common Philippine endemic is frequently encountered in residential and agricultural areas and along forest edges (Leviton, 1968b; Brown *et al.,* 1996, 2000a, in review; Siler *et al.,* 2011a). Site 22: CAS 15265–67.

Dryophiops philippina **(Boulenger 1896):** This widespread species was previously collected frequently throughout the country (Leviton, 1964a). In the last century this snake has become increasingly rare, probably as a result of forest removal in coastal areas throughout the country (McLeod *et al.,* 2011). One live individual was found in Camayan Beach Resort (Figure 30), and another near Ocean Adventure. *Dryophiops philippina* was also a common road-kill victim, with five specimens found during the ADS survey along Ilanin and Corregidor roads. Site 11: CAS 15327.

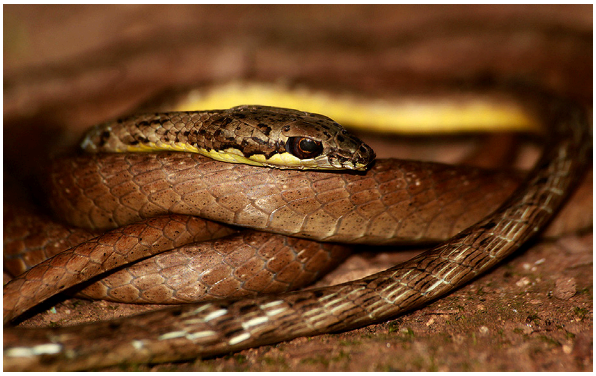

Figure 30 *Dryophiops philippina* from Site 4 (Specimen not collected). Photograph by ADS.

Gonyosoma oxycephalum **(Boie 1827):** A single specimen was found dead on the Ilanin Road, 1 km from Ocean Adventure. Another specimen (Figure 31) was photographed near Camayan Beach Resort along the Ilanin Road. We suspect this species is common within the SBF and will be documented in future surveys. Site 3: TNHC 62714; Site 4: No specimens (Photo voucher by L. J. A. Suarez)

Lycodon capucinus **(Boie 1827):** This common species is known throughout the archipelago (Brown *et al.,* 2000a, in review; Leviton, 1965a; Siler *et al.,* 2011a); it is frequently encountered in agricultural areas and around human habitations. Site 11: CAS 15256; Site 12: CAS 15253–55; Site 22: CAS 15257.

Oligodon ancorus **(Girad 1858):** A dead specimen was found along the Ilanin Road about 1 km from the entrance to Ocean Adventure. Another road-kill specimen was encountered dead on the road outside SBMA's White Rock Water Park and Beach Resort in 2000 (RMB,

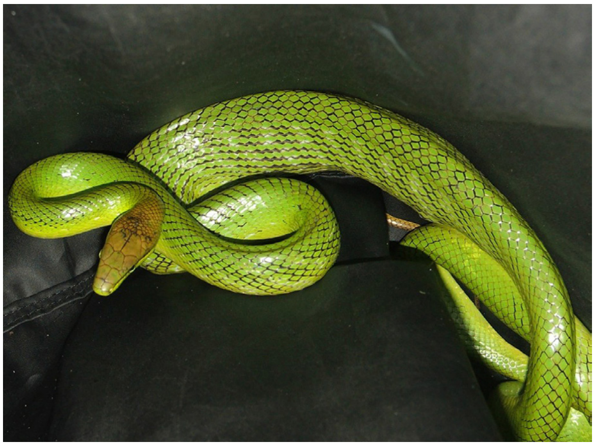

Figure 31 *Gonyosoma oxycephalum* from Site 4 (Specimen not collected). Photograph by L. J. A. Suarez.

personal observation) but could not be collected and preserved due to permitting restrictions. Another specimen (Figure 32) was photographed near Camayan Beach Resort along Ilanin Road. This is another species that was commonly collected over the last century (Leviton, 1962) but which may be rare now due to it apparent reliance on low elevation, coastal forests. Site 22: No specimens; Site 4: No specimens (Photo voucher by L. J. A. Suarez)

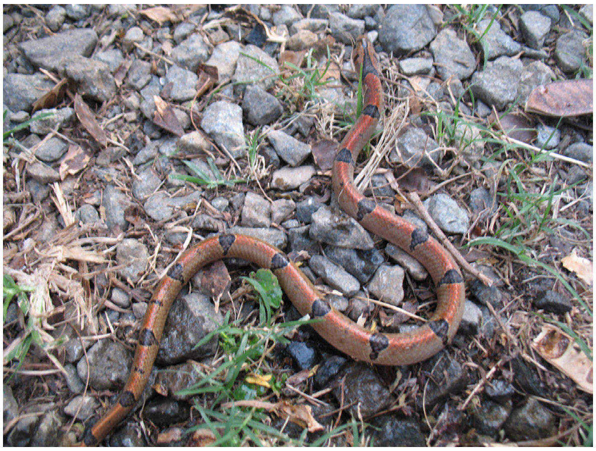

Figure 32 *Oligodon ancorus* from Site 4 (Specimen not collected). Photograph by L. J. A. Suarez.

Ptyas luzonensis **(Günther 1873):** Two specimens (Figure 33) were collected as the slept in understory branches along the banks of small streams in the Ilanin Forest. This increasingly common species is active during the day (and seldom collected then) but can be reliably located sleeping in branches in the vicinity of water at night (Brown *et al*., 2000b, in review; Diesmos *et al*., 2005; Siler *et al*., 2011; McLeod *et al*., 2011). Site 1: One uncatalogued specimen at PNM; Site 3: TNHC 63002

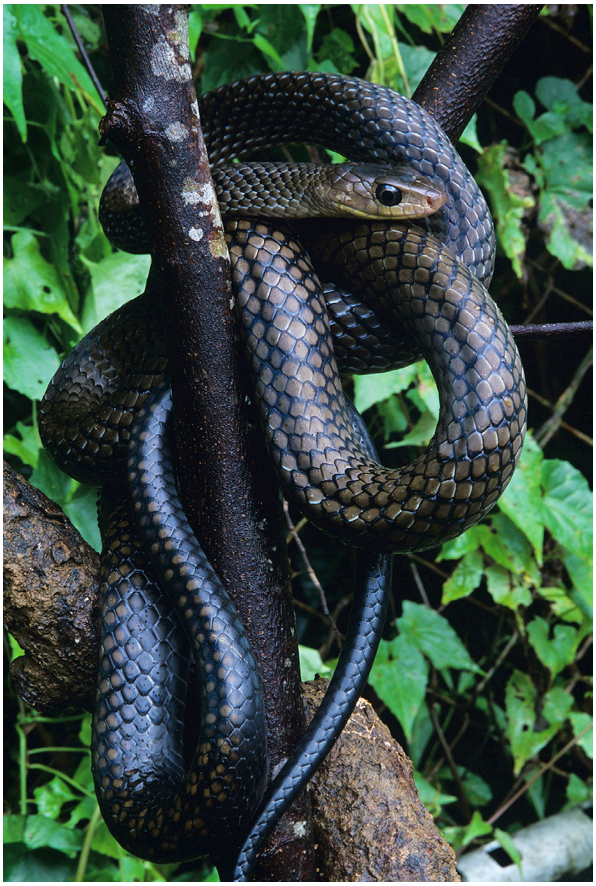

Figure 33 *Ptyas luzonensis* from Site 2 (TNHC 63002). Photograph by RMB.

Rhabdophis spilogaster **(Boie 1827):** Both juveniles and adults were found in flowing streams, hiding among rocks or under fallen leaves or woody debris. One specimen (Figure 34) was found actively crawling in leaf litter on Hill 394. Site 1: TNHC 62735–36, two uncatalogued specimens at PNM; Site 5: TNHC 62734; Site 6: Site 12: CAS 15226–27; CAS 15217; Site 13: CAS 15222; Site 14: CAS 15225; Site 18: CAS 15223–24; Site 22: CAS 15215–16, 15218–19.

Family: Elapidae (Cobras, coral snakes, and sea snakes).

Hemibungarus calligaster **(Wiegmann 1835):** A single dead *H. calligaster* was found along the highway about 2 km from Building 8494; another live specimen was captured, photographed, and released (by L. J. A. Suarez) near Camayan Beach Resort. Site 3: No specimens (Photo voucher by L. J. A. Suarez); Site 6: No specimens.

Lapemis hardwickii **Gray 1834:** A single specimen of this widespread pacific sea snake was collected in 1908 by

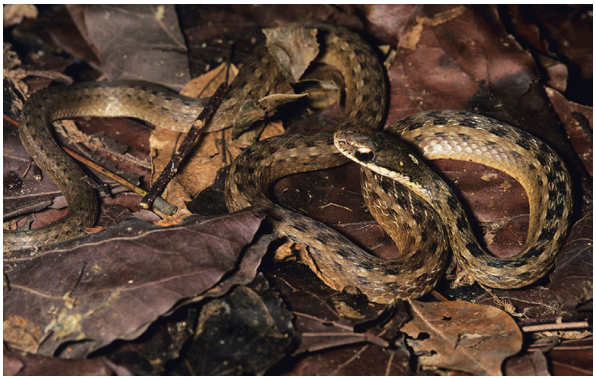

Figure 34 *Rhabdophis spilogaster* from Site 2 (TNHC 62735). Photograph by RMB.

an unknown collector. Site 19: USNM 38593.

***Laticauda colubrina* (Schneider 1799):** One specimen of this species was collected on the Grande Island, in Subic Bay by J. C. Thompson in 1907. A second specimen was collected in Subic Bay as it swam alongside the U. S. S. Mohican. Ocean Adventure divers (ADS, personal communication) occasionally observed this species close to shore on small reefs within Subic Bay. Site 9: CAS 15165, 15166.

***Naja philippinensis* Taylor 1922:**This endemic Philippine cobra is yet another species that was quite common over the last century (Leviton, 1964c), but which appears to be increasingly rare in lowland habitats of Luzon today, probably as a result of persecution by humans, and habitat destruction (Brown *et al.,* 1996, 2000a; Siler *et al.,* 2011a). One road-kill specimen was collected on the road bordering the Ilanin Forest; another live specimen (Figure 35) was photographed near Camayan Beach Resort along the Ilanin Road. Site 3: TNHC 63066; Site 4: No specmens (Photo voucher by L. J. A. Suarez); Site 15: USNM 345028, CAS 15338.

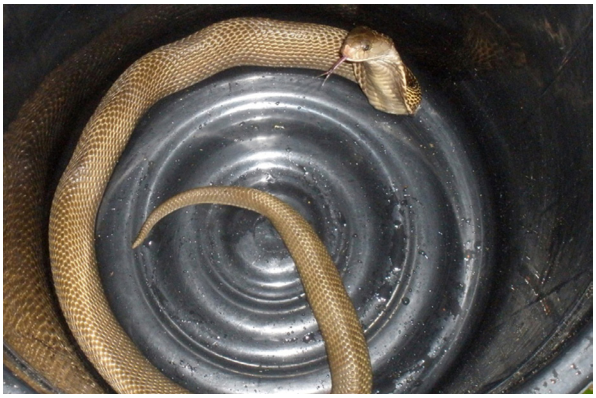

Figure 35 *Naja philippinensis* from Site 4 (Specimen not collected). Photograph by L. J. A. Suarez.

***Ophiophagus hannah* (Cantor 1836):** A single live specimen (Figure 36) was caught, photographed, relocated and released (by Ocean Adventure staff members) near Camayan Beach Resort along the Ilanin Road. Site 4: No specimens (Photo voucher by L. J. A. Suarez)

Family: Viperidae (Pit vipers).

***Trimeresurus flavomaculatus* (Gray 1842):** We frequently found individuals of this Luzon faunal region species (Leviton, 1964b) in or within close proximity to flowing streams (Figure 37). Specimens were encountered as they perched in lower branches of saplings on the banks of flowing water. One small temporary pond in the Ilanin Forest had five *T. flavomaculatus* specimens along its banks, feeding on *Occidozyga laevis*. A single specimen was found crawling along the ground in grass on the banks of the river at the Boton Falls. Site 1: TNHC 62989; Site 3: TNHC 62732, three uncatalogued specimens at PNM; Site 5: TNHC 62733; Site 9: TNHC 62737

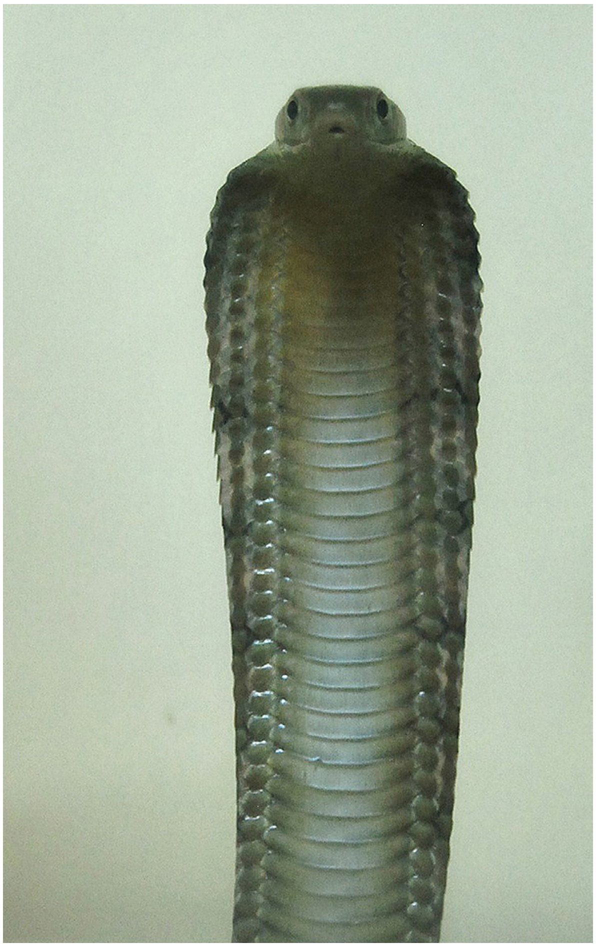

Figure 36 Juvenile *Ophiophagus hannah* from Site 5 (Specimen not collected). Photograph by L. J. A. Suarez.

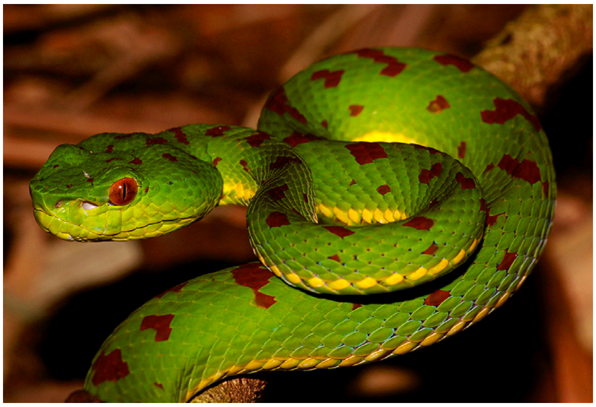

Figure 37 *Trimeresurus flavomaculatus* from Site 3 (Specimen not collected). Photograph by ADS.

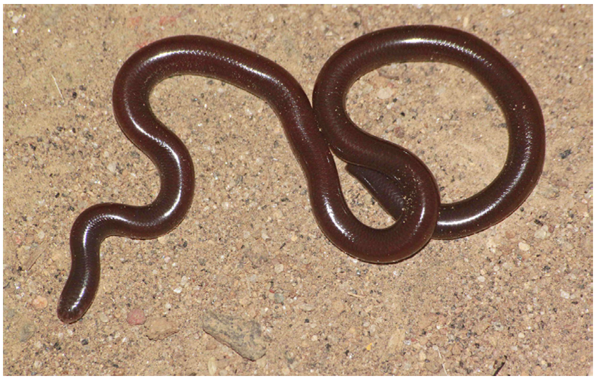

Figure 38 *Ramphotyphlops braminus* from Site 3 (Specimen not collected). Photograph by ADS.

Family: Typhlopidae (Blind snakes)
***Ramphotyphlops braminus* (Daudin 1803):** Specimens were collected under the cover of trash, woody debris, houseplants, and woodpiles. This species (Figure 38) frequently is collected in agricultural clearings and around residential areas. Site 10: CAS 15173–74; Site 11: CAS 15172; Site 16: KU 94540–45; Site 21: CAS 15171, 15175; Site 22: CAS 15175–76.

***Typhlops ruficaudus* (Gray 1845):** A single specimen of this distinctive species was collected on Telegraph Trail by J. C. Thompson in 1907. Site 23: CAS 15181.

Order: Testudines (Turtles)
Family: Geoemydidae
***Cuora amboinensis* (Daudin, 1801):** Individuals of this species (Figure 39) were encountered hiding under leaf litter in the streams and hiding in between boulders. One specimen was collected as it crawled under water, against the current of the Ilanin River. Seven specimens collected by J. C. Thompson in 1907 only bear the locality data "Zambales Province" (CAS 15376–82). Despite the uncertain provenance, we suspect that these specimens originated in the vicinity of Subic Bay, along with the remainder of Thompson's collections. Site 1: TNHC 62989.

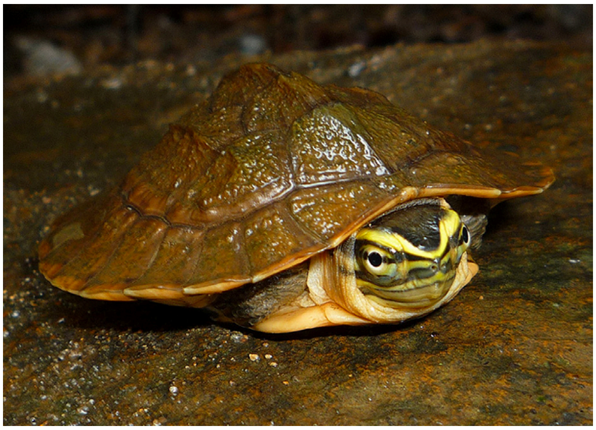

Figure 39 *Cuora amboinensis* from Site 3 (Specimen not collected). Photograph by ADS.

4. Discussion

This study provides a current summary of the amphibians and reptiles now known from the historically significant and forested area surrounding Subic Bay, Luzon Island. In one sense, for an area of relatively little geographic relief (The immediate coastal forests surrounding the bay are all under 400 m), predominantly sandy soil substrates, and relatively simple plant communities (The forest reserve is dominated by a single native bamboo species), we would not expect the immediate vicinity of Subic Bay to be exceptionally diverse. On the other hand, our records document a total of 55 species, which is comparable to one forested, elevationally stratified site in the northern end of the Zambales Mountains (Brown *et al.,* 1996) and montane sites in the northern Cordillera (Brown *et al.,* in review; Diesmos *et al.,* 2005). Compared to a recently surveyed Bulacan Province (63 species) site, the diverse herpetological communities of Aurora Province (82 species; Brown *et al.,* 2000a, Siler *et al*., 2011a), and herpetological communities of the northern Sierra Madre (83–85 species; Brown *et al.,* unpublished data), Subic Bay herpetological diversity is moderate, but still quite impressive.

Numerous species were not encountered during our survey and yet we suspect they eventually will be recorded in the area if researchers can access additional microhabitat types and conduct fieldwork at different times of the year (both dry and rainy seasons) and a greater range of elevational relief. In a recent study of low- to mid-elevation forests of the northern Cordillera

Mountains, Brown *et al*. (in review) discussed two pairs of studies in which herpetological diversity of a general area was increased substantially by follow-up visits focusing on different habitat types, forest communities, geological features of the landscape, and varying atmospheric conditions (Brown *et al.,* 2000a, in review; Diesmos *et al.,* 2005; Siler *et al.,* 2011a). The obvious conclusion behind both of these pairs of studies is that no herpetological community can be reasonably well known as a result of a single survey effort, at one site and only a single time of year.

Species that we expect will eventually be recorded in the vicinity of Subic Bay include the frogs *Platymantis dorsalis, P. luzonensis, Kaloula kalingensis, Rhacophorus pardalis, R. bimaculatus, R. appendiculatus* and possibly the introduced species *Hoplobatrachus rugulosus* and *Kaloula pulchra.* We anticipate that a number of lizards will eventually by discovered in Subic Bay, including *Lipinia pulchella, Parvoscincus decipiens, P. steerei, P. boyingi, Brachymeles bonitae, B. kadwa,* and possibly *B. boulengeri.* In a recent study from extreme southwest Luzon (Cavite Province), Welton *et al.* (in review) documented the presence of a frugivorous monitor lizard related to *Varanus olivaceus* (the first record from western Luzon); it remains entirely possible that a frugivorous monitor lizard may be present in forested regions of the Zambales Province. Snakes that we expect eventually will be recorded in Subic Bay include *Boiga cynodon, B. dendrophila, Calamaria gervaisi*, *C. bitorques, Hologerrhum philippinum, Lycodon muelleri, Psammodynastes pulverulentus, Tropidonophis dendrophiops, Oxyrhabdium leporinum,* and *Tropidolaemus subannulatus.* In addition, large rivers in and around Subic Bay could still contain populations of softshell turtles (*Pelochelys cantorii*) and saltwater crocodiles (*Crocodylus porosus*).

A renewed interest in Luzon's herpetofauna over the past two decades has resulted in species being discovered at an accelerated rate (Brown and Diesmos, 2002; Brown *et al.,* 2002, 2008; Diesmos and Brown, 2011; Brown and Stuart, in press) along with new data on species composition as a function of elevational stratification, forest type, seasonality, and geology (e. g., W. Brown *et al.,* 1997a–c, 1999a, b; R. Brown and Gonzales, 2007; Brown *et al.,* 1995, 1996, 1999, 2000a, b, 2002, 2007; Diesmos *et al.,* 2002; Linkem *et al*., 2010a, b; Siler *et al.,* 2010, 2011a, b; Wallach *et al*., 2007). More recently, several studies have targeted survey efforts towards the anticipated subcenters of Luzon's herpetological diversity, in an effort to document abundance, microendemism, and distribution patterns across the island (Brown *et al.,* 2000a, in review; Diesmos *et al.,* 2005; McLeod *et al.,* 2011; Siler *et al*., 2011a).

As exciting as these discoveries are, they occur against a backdrop of crippling human-induced habitat loss throughout Luzon (Collins *et al.*, 1991; Kummer, 1992; Kummer and Turner, 1994; Food and Agriculture Organization, 2000; Myers, 1988; van der Ploeg *et. al*., 2011; World Resources Institute, 2003). Even high-priority regions such as the Zambales Mountain Range—and entirely unique geological massif with considerable taxonomic endemism (Brown *et al.,* 1996, 2010; Yumul *et al*., 2000, 2009)—lack protected areas (Mallari *et al.* 2001; Ong *et al*., 2002).

With high levels of endemism, and as much as 90% of Philippine species classified as forest obligates (Brown, 2007; Diesmos *et al.,* 2002; Diesmos and Brown, 2011), Philippine vertebrate forest fauna is particularly vulnerable to habitat loss and degradation. This pattern is magnified in amphibians and reptiles, because herpetological endemism occurs on a much finer scale than in other vertebrate groups (Brown *et al.,* 2000a, 2002, in review; Diesmos *et al.,* 2002; Siler *et al.,* 2011a). All these trends reflect the urgent need for continued research focused on biodiversity Philippine amphibians and reptiles (Diesmos and Brown, 2011). Sustained conservation practices will be necessary to mitigate the effects of habitat loss, which threaten to destroy Luzon's biological diversity even before it has been fully documented (Brown *et al.,* 2000, 2008, in review; Ron and Brown, 2008; Diesmos and Brown, 2011; Brown and Stuart, in press; McLeod *et al.,* 2011). Continued surveys throughout the isolated, geologically unique, and herpetologically unknown Zambales Mountains massif must continue to be a high-priority component of this effort.

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